the cloud which the balloon entered was the same as that observed in the nephoscope, and while it is not certain that the cloud entered was part of the lowest layer of strato-cumulus, the circumstances seem to justify the assumption that the nephoscope observation is applicable to the place where the balloon disappeared. In the first place the direction of motion of the cloud as observed was from 122° and that of the balloon during the last minute of flight was from 120°. Above this lowest (?) series of strato-cumulus bands were two others; the next higher (?) one was from 130 to 135° at a speed of 5.9 to 6.4 m/s for each kilometer of elevation, and the highest (?) was from 130° at a speed of 3.7 m/s for each kilometer of elevation. It was estimated at the time that the highest layer was at about 3 kilometers.

Assuming that the balloon entered the lowest layer of strato-cumulus, which were moving at the rate of 7 m/s for every thousand feet of elevation, it should have been moving at the rate of 12.6 m/s at the 1,800 meter level (the assumed altitude). If it had been moving at that rate, however, during the last minute of flight, it would have been carried out to a point 756 meters beyond where it was at the end of the eighth minute, or to a point 7,416 meters from the station. At that point, with an elevation angle of 14.3° as observed, the height of the balloon would have been 1,890 meters, which in turn would give us a velocity of 13.2 m/s, as the nephoscope readings indicated a velocity of 7 m/s for every kilometer of elevation.

Assuming a velocity of 13.2 m/s we carry the approximation one step farther, and obtain a distance out of 7,452 meters, an altitude of 1,900 meters, and a velocity of 13.3 m/s. Further approximations do not materially alter this result.

Since the balloon was so inflated as to reach 1,800 meters in 9 minutes under ordinary conditions, it appears to have gained 100 meters during the last minute of its flight on account of ascensional air currents.

A CONTRIBUTION TO THE METEOROLOGY OF THE ENGLISH CHANNEL.

By HUGH D. GRANT.

[Noted from *The Aeronautical Journal*, January, 1921, pp. 25-38.]

Owing to the notorious capriciousness of the weather of the English Channel, and to the vast dependence of transchannel navigation, both marine and aerial, upon these vagaries, this study has been made. It is an attempt to analyze the barometric disturbances which give rise to the channel weather, and the relation of the topography to the sudden changes which occur. Winds, in mid-channel and along the coast, were studied; the latter were investigated by means of pilot balloons which were filled so as to be in equilibrium in the surface air, and by this means a very good idea of the turbulence and gusts along the steep cliffs between Dover and Folkestone was obtained. Fogs, thunderstorms, gales, and squalls are also considered. It is pointed out that the number of well-equipped observatories and dense population on both sides of the channel afford unusual advantages to the investigator, owing to the large number of voluntary observers.—*C. L. M.*

PILOT-BALLOON WORK IN CANADA.

By J. PATTERSON.

[Presented before the American Meteorological Society, Chicago, Dec. 28, 1920.]

(Author's Abstract.)

The Meteorological Service of Canada in conjunction with the Air Board of Canada has established a series of pilot-balloon stations across the country. Last year stations were opened at Vancouver, British Columbia, Morley Alta (near Calgary), Camp Borton, Toronto, and Ottawa, Ontario, and Roberval (Lake St. John), Quebec. It is the intention to open stations this spring at Peace River Crossing and Fort Good Hope on the MacKenzie River. The one theodolite method was used and results plotted in the usual way.

THE MAKING OF UPPER-AIR PRESSURE MAPS FROM OBSERVED WIND VELOCITIES.[1]

By C. LEROY MEISINGER.

[Weather Bureau, Washington, D. C., Nov. 27, 1920.]

SYNOPSIS.

If the equation which expresses the relation between the speed of the wind and the distribution of barometric pressure be solved for the gradient in terms of the observed speed, density of the air, radius of curvature of the wind path, and latitude, it is possible to work out a fairly accurate map of the distribution of barometric pressure at upper levels. This has been done for the observations made about 8 a. m., March 27, 1920, at most of the aerological stations of the Weather Bureau and the Signal Corps. The pressures observed by kites, when used in connection with the computed gradients, give the clue to the values of the absolute pressures at the level in question. Maps of the 1, 2, and 3 kilometer levels were thus constructed.

The gradient wind.—If it is assumed, as is usually justifiable, that the effect of the friction of the earth's surface is negligible at about 500 meters above the surface, it should be possible to use observed wind velocities as a basis for determining the distribution of pressure aloft. The gradient wind equation is frequently used to determine the speed of the wind, using as a basis the sea-level distribution of pressure, but it is obvious that, by solving the equation for the gradient in terms of the speed, the density of the air, the radius of curvature of the wind path, and the latitude, an accurate upper-air map ought to result if based upon sufficient observations. Pilot-balloon observations give only wind speed and direction at various heights; and with these data alone it is possible to determine the gradient but not the absolute pressure. This deficiency may be supplied by kite observations which, when reduced, give the absolute value of the pressure at various levels. Since wind direction is an index to the direction of the isobar and, therefore, the gradient, (the latter being normal to the former) we are enabled to determine quite accurately the radius of curvature of the path. The density may be determined from kite data also. Thus we have all the necessary values to substitute in the equation.

If we take the three equations for the velocity of the gradient wind, as given by Dr. W. J. Humphreys,[2] namely:

(1) . . . $v=\sqrt{\frac{r}{\rho}\frac{dp}{dn}+(r\omega\sin\phi)^2}-r\omega\sin\phi$ for cyclones;

(2) . . . $v=\frac{\frac{dp}{dn}}{2\omega\rho\sin\phi}$ for straight isobars;

(3) . . . $v=r\omega\sin\phi-\sqrt{(r\omega\sin\phi)^2-\frac{r}{\rho}\frac{dp}{dn}}$ for anticyclones, and solve them for $\frac{dp}{dn}$, we obtain, respectively,

[1] Presented before the American Meteorological Society at Chicago, Dec. 28, 1920.

[2] *The Physics of the Air*, Franklin Institute, 1920, pp. 139-140.